1.4 Research Needs

Introduction

Surveillance data, stakeholder/customer requests, and risk/loss control requirements are used to define the research priorities, and these determine the overall goals. The causes of fatalities, lost-time injuries, and occupational illnesses obtainable from surveillance data drive our program decisions. Meetings with stakeholder and customer groups are used to generate lists of needs they feel are greatest. In general, there is remarkable agreement among the different groups. Finally, the risk/loss control component attempts to address low-probability but high-impact events like mine explosions or inundations. An extremely brief summary of each of these "portfolio drivers" is presented in the remainder of this section.

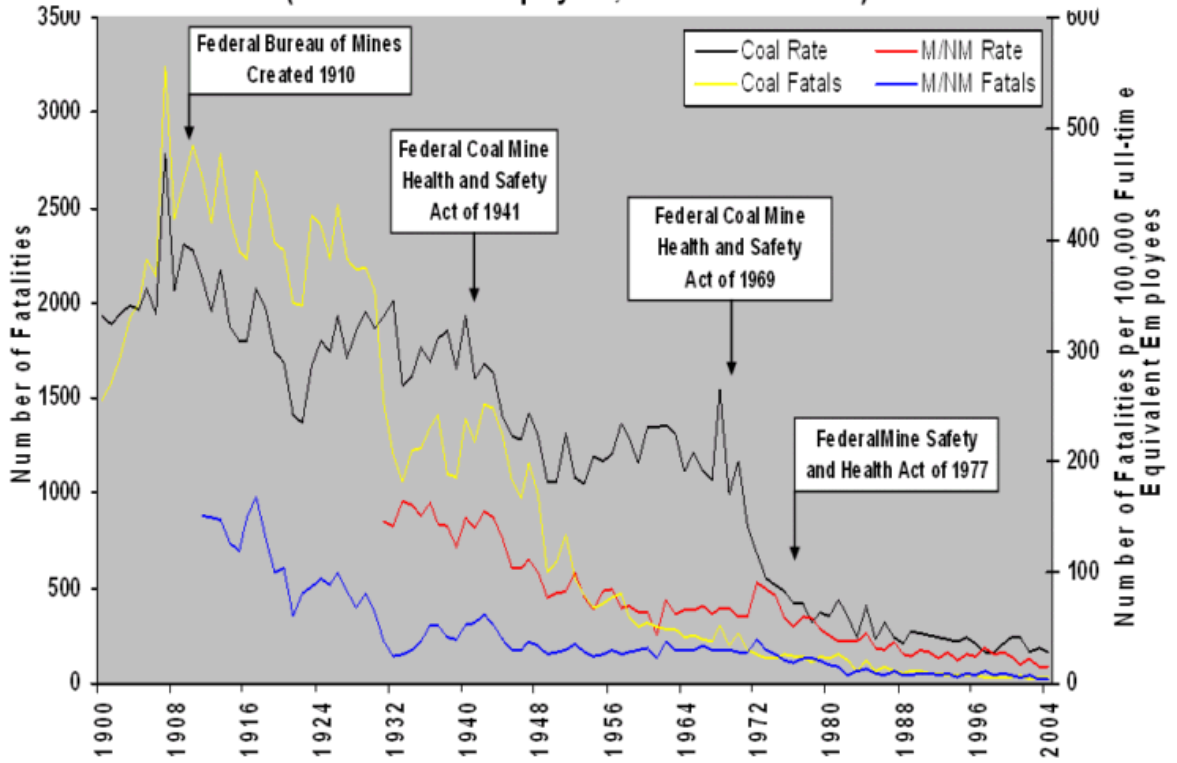
Surveillance Data

Surveillance data is obtained primarily from the MSHA and BLS databases, and then analyzed to establish research priorities or assess the effectiveness of past research. Here the surveillance data are highlighted within the three categories of fatalities, injuries, and illnesses. Although not shown here, the data are analyzed across many categories including the type of commodity, geographic location, and in-mine parameters, among others.

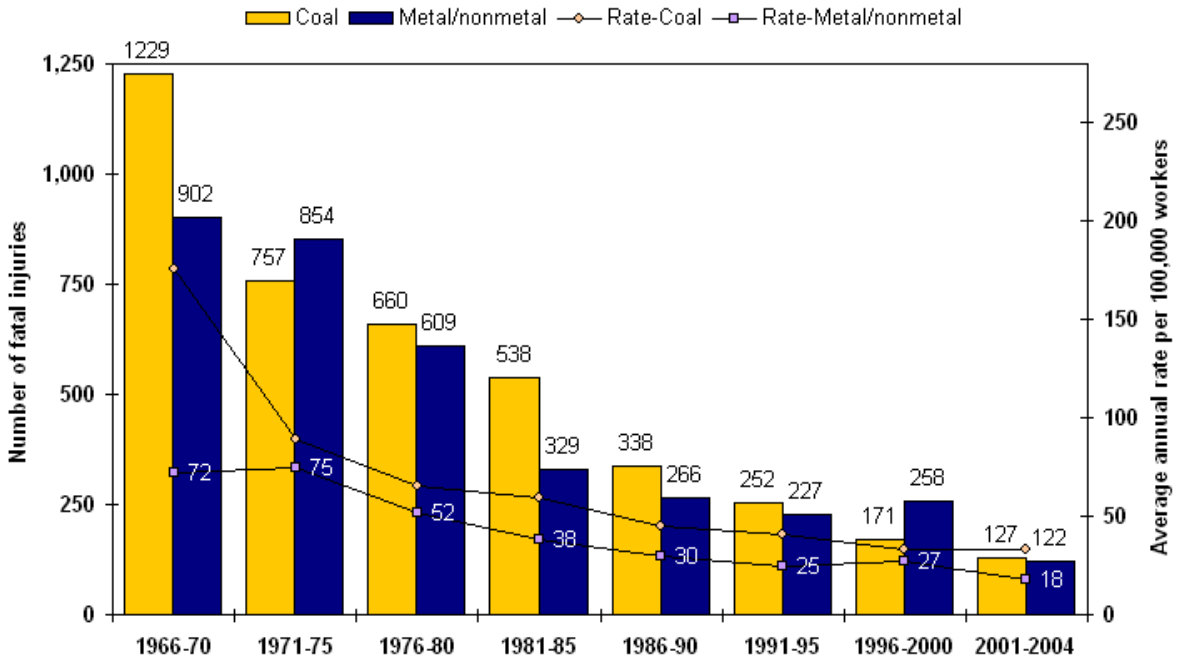
Fatalities

Over the last century, huge progress has been made in reducing the frequency of mining fatalities as shown in the figure below, which is the result of legislative, labor, corporate, research, and technological interventions.

Number of Fatalities and Fatality Rates in the Mining Industry by Commodity, 1900-2004
(Excludes Office Employees; Data Source: MSHA)

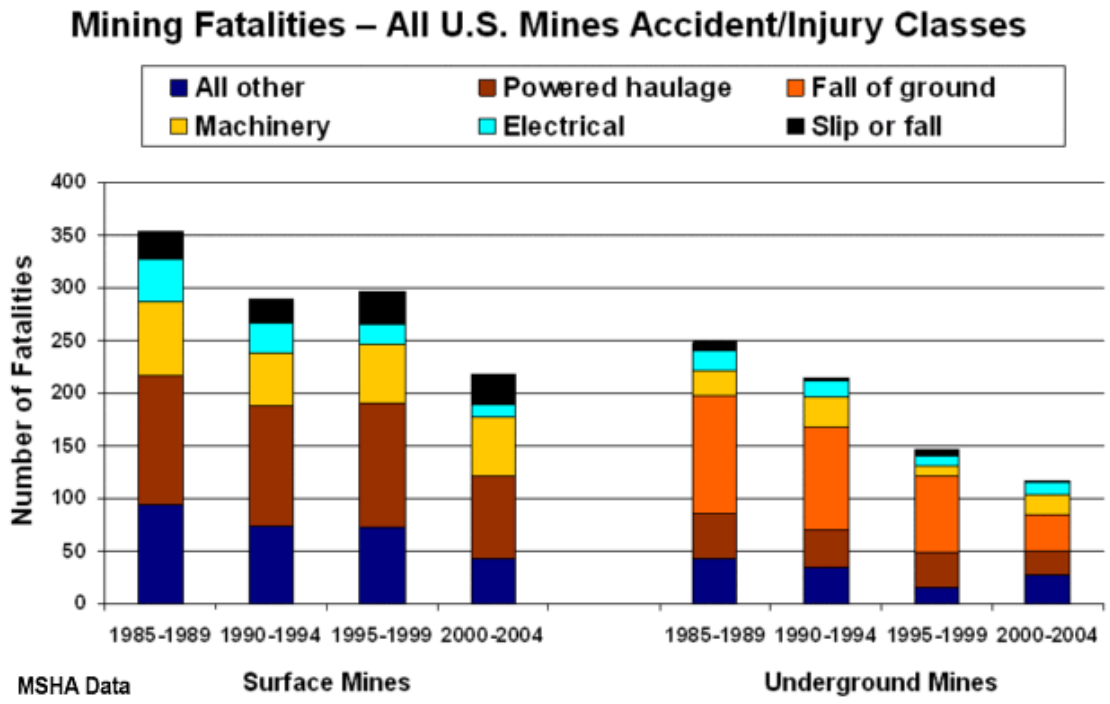


Number and Rate of Mining Fatalities in Coal and Metal/nonmetal mining



The data for the previous 2 charts are from the MSHA public data files downloadable at http://www.msha.gov/STATS/PART50/p50y2k/p50y2k.HTM.

The frequency of these events varies by the commodity being mined (figure above) and whether the mine is on the surface or underground (figure below). For 2001-2004, the fatality rate for miners was 33 per 100,000 Full-time-equivalents (FTE) in coal mining and 18 in metal/nonmetal mining. These contrast to a rate of 4.1 for all industry (overall industry fatality rate: BLS Web site, http://www.bls.gov/iif/oshwc/cfoi/cfch0003.pdf



During the five-year period 2000 through 2004, the five leading major causes of underground mining fatalities were:

1. 28% fall of ground
2. 21% powered haulage
3. 17% machinery
4. 16% explosions
5. 10% electrical

These five causes account for 92% of the fatalities.

During the same period, the five leading causes of surface mining fatalities were:

1. 37% powered haulage
2. 25% machinery
3. 14% slip or fall of person
4. 8% fall of rock or highwall
5. 5% electrical

These five causes account for 89% of the fatalities in surface mining and processing operations. It bears mentioning that for the interval 1992-2002, overall employment in surface mining operations was estimated to be 217,000, while that in underground operations was 46,000 (NIOSH Chartbook, 2004), so the fatality rate was higher for underground miners.

Based on the leading causes of fatalities in underground and surface mining, our priorities are to address traumatic injury fatalities from powered haulage and machinery, fall of ground, explosions, slips and falls, and electrocutions.

Lost-time Injuries

For the period from 2000 through 2004, the nonfatal lost-time injury rate for mining is 4.5 injuries per 100 FTE in coal mining and 2.9 in metal/nonmetal mining. This contrasts to a rate of 2.6 (2003 rate) for all industry. The higher rate in coal mining leads us to place greater emphasis on research for injury reduction in this mining sector.

The five leading causes of nonfatal lost time injuries in underground mining are:

1. 33% handling materials
2. 18% machinery
3. 17% slips and fall of person
4. 12% powered haulage
5. 9% fall of ground

These five causes account for 89% of the nonfatal lost time injuries.

The five leading causes of nonfatal lost time injuries in surface mining are:

1. 36% handling materials
2. 28% slip or fall of person
3. 10% hand tools
4. 10% machinery
5. 9% powered haulage

These account for 95% of the nonfatal lost time injuries incurred by surface mine workers.

The frequency of nonfatal lost-time injuries provides insight into how many and what types of injuries are occurring. A second metric, severity, as defined by the median number of days lost, helps to further characterize the overall importance of the injury class. Note that this measure combines actual lost work days, statutory days lost, and days of restricted work activity through the following formula: Total days lost is calculated as the maximum of statutory days lost, or the sum of actual days lost plus days restricted, whichever is greater. The severity of nonfatal lost time injuries in underground mining for 2000-2004, ranked by severity, is shown below.

1. Slip or fall of person, 26 days
2. Powered Haulage, 23 days
3. Machinery, 21 days
4. Handling materials, 20 days

5. Fall of ground, 19 days

For surface mining for 2000-2004, the lost time injury classes, ranked by severity, are shown below.

1. Fall of ground, 20 days
2. Slip or fall of person, 16 days
3. Powered haulage, 13 days
4. Handling materials, 12 days
5. Machinery, 10 days

Illnesses

The following are the occupational illnesses and diseases newly reported to MSHA, by category (from MSHA public file for 2004):

1. Repetitive trauma, 43.1%
2. Hearing loss, 20.9%
3. Dust diseases of the lungs, 16.9%

These top three account for 81% of the newly reported cases. Uniquely, dust diseases can result in death, and for 1999, the most recent year for which data is available, 1003 people died from coal worker pneumoconiosis. During the 1990s, deaths from coal worker pneumoconiosis ranged from 1000 to 2000 per year. Silicosis death statistics in the mining industry are not as readily available, since many states do not report the associated industry with the silicosis-related death. For those states which do report the associated industry, the data shows that mining is responsible for approximately 25% of the deaths. Mining machine operators represent the occupation with the highest number of silicosis-related deaths, and account for about 16 % of the U.S. deaths due to silicosis. The provenance for the lung disease figure is DRDS's "WORLD" report, but the most recent one is quoted. http://www.cdc.gov/niosh/docs/2003-111/pdfs/2003-111.pdf, p28 has the table with the 1999 total of 1003 deaths.

Stakeholder/Customer Requests

Another major factor in setting research priorities is the input we receive from stakeholder groups, which have great knowledge and concern about the health and safety of miners. Some of the major customers/stakeholders who provide input are the following: Labor: United Mineworkers of America, United Steelworkers of America, and International Union of Operating Engineers; Industry: Bituminous Coal Operators Association, National Mining Association, National Stone, Sand, and Gravel Association, and Industrial Minerals Association of North America. In addition, several state organizations, universities, manufacturers, and government agencies participate in research partnerships and provide important input to the list of priorities. NIOSH also maintains a standing advisory committee: the Mine Safety and Health Research Advisory Committee.

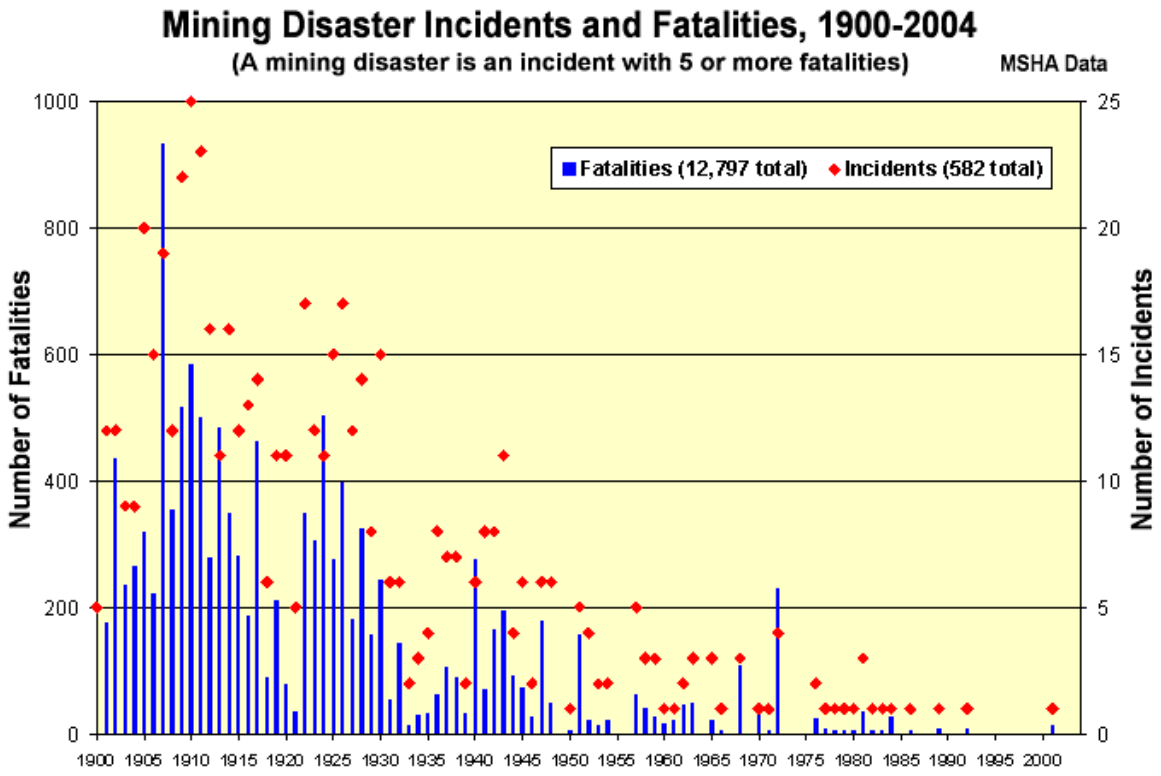
The areas of greatest need, as identified by the stakeholder groups are:

- Dust monitoring and control
- Noise control
- Diesel emissions control
- Disaster prevention and response

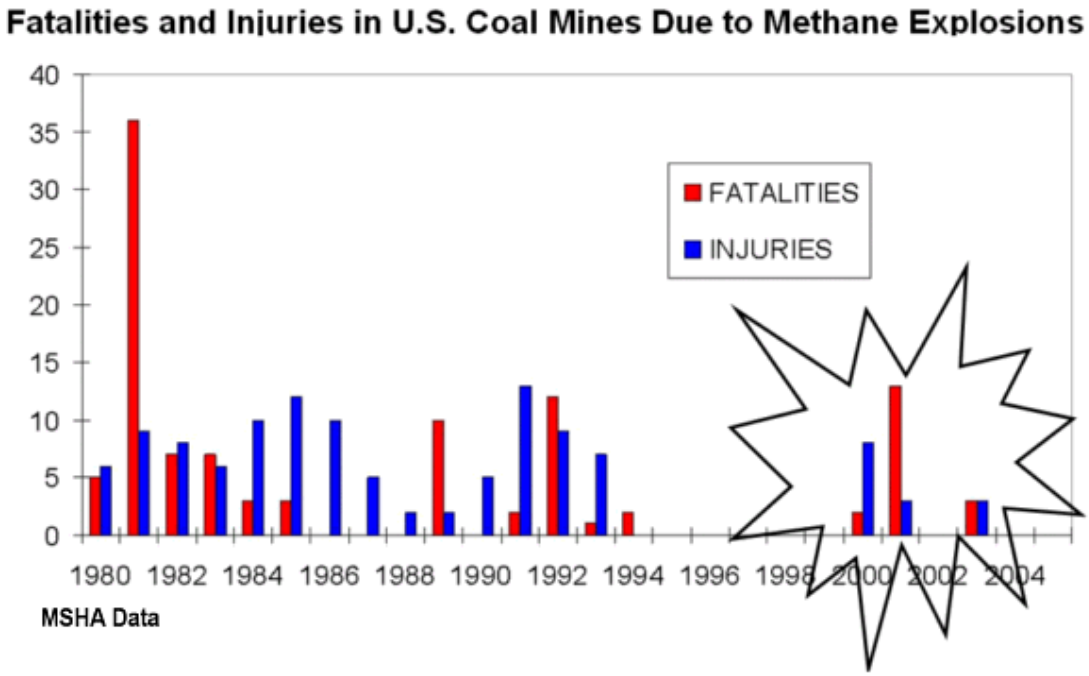
One major influence on these interests and perceived needs is any impending regulatory change. Other areas of strong stakeholder interest and stated need are ground control, training, machine and electrical safety, ergonomics practices, and blasting health and safety.

Loss Control

The third component of the "needs analysis" addresses the low-probability but high-impact events. These are mine explosions, mine fires, mine collapse, and mine inundations. While these events have become much less deadly over time, they still do occur, albeit sporadically as shown in the figure below. As part of the needs analysis, sentinel events and other indicators are tracked. All of the indicators point to increasing risk of disaster from explosions, fires, and inundations. In large part, this is due to the worsening conditions as mines progress into gassier deposits, go deeper, and work under generally more adverse geologic conditions. The greatest risks are in underground coal mining, although metal/nonmetal mining entails significant risks as well. In addition to preventing these disasters, a concurrent priority is to develop safer and more effective response methods and technologies.



While there has been significant progress on preventing underground mine disasters, there has been an increase in the occurrence of injuries and fatalities due to methane explosions in underground coal mines in the past five years. This indicates that we must always be vigilant to ensure mine workers are protected from catastrophic events. Research is continuing, and because of this recent trend in some cases expanding, to address the factors associated with coal mine methane explosions. The research encompasses methane drainage technology, frictional ignition prevention, seals and barrier designs, fire detection and suppression systems essentially a broad spectrum of investigations intended to expand the knowledge and technology for preventing underground mine fires and explosions.



NIOSH Role, Decision-Making, and Intervention

CDC and NIOSH often invoke the "surveillance cycle" as the theoretical framework for our method of operations. This provides a helpful model for public health practice based on surveillance data. For mining safety and health events, MSHA is the jurisdictional agency and, thus, the primary collector of data. NIOSH's important roles fall in the other three major areas of effort: consolidation and interpretation of data, dissemination, and recommending/planning for action to control and prevent the recurrence of these untoward events. The cycle repeats, with the roles remaining similar.

CDC and NIOSH often use a hierarchy in decision making to enable some comparison of disparate outcomes and events (in descending rank order):

1. Death (with multiple deaths set as highest priority for investigation and prevention)
2. Permanent disability and/or disfigurement
3. Severe/serious injury with long and/or painful rehabilitation

4. Lost time/wage events
5. Costly injuries not fitting prior stated categories
6. Potentially dangerous incidents not resulting in injuries
7. Hazards

Applying those criteria to the major categories of problems that the NIOSH Mining S&H program addresses, the surveillance data point toward 6 areas of greatest need (not ranked):

- Disaster Prevention
- Respiratory Diseases
- Traumatic Injuries (e.g. powered haulage, machinery, slips and falls, and electric shock)
- Hearing Loss
- Repetitive/Cumulative Musculoskeletal Injuries
- Fall of Ground